

A-0308-6-39

January 23, 2006

Mr. Larry Hanson
Division of Solid Waste Management
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: Interim CSA Report
SLF# 06-008-001
Old Amherst Landfill, Amherst, MA

Dear Larry:

On behalf of the Amherst Department of Public Works, enclosed are two (2) copies of the Interim Comprehensive Site Assessment (CSA) Report for the Old Amherst Landfill site. The Interim CSA study was completed in general accordance with Item 13 of Massachusetts Department of Environmental Protection (MDEP) correspondence dated June 29, 2005, and modified by MDEP correspondence dated October 27, 2005 and our discussions during the completion of the study.

If you have any questions or comments regarding the Interim CSA Report, please do not hesitate to contact Executive Vice President Michael R. Parsons, P.E. at (413) 572-3202 or me at (413) 572-3260.

Very truly yours,

TIGHE & BOND, INC.



Jeffery J. Thelen, P.G.
Senior Hydrogeologist

Enclosures

J:\A\A0308\OLD LF CSA\0106 INTERIM CSA MDEP TRANS LTR1.DOC

Copy: Guildford Mooring, P.E., Superintendent (2 copies)
Robert Pariseau, Director of Water Resources (1 copy)



Enter your transmittal number

W 072576

Transmittal Number

Your unique Transmittal Number can be accessed online: <http://www.mass.gov/dep/counter/trasmfrm.shtml> or call DEP's InfoLine at 617-338-2255 or 800-462-0444 (from 508, 781, and 978 area codes).

Massachusetts Department of Environmental Protection

Transmittal Form for Permit Application and Payment

1. Please type or print. A separate Transmittal Form must be completed for each permit application.

2. Make your check payable to the Commonwealth of Massachusetts and mail it with a copy of this form to: DEP, P.O. Box 4062, Boston, MA 02211.

3. Three copies of this form will be needed.

Copy 1 - the original must accompany your permit application. Copy 2 must accompany your fee payment. Copy 3 should be retained for your records

4. Both fee-paying and exempt applicants must mail a copy of this transmittal form to:

DEP
P.O. Box 4062
Boston, MA
02211

* Note:
For BWSC Permits,
enter the LSP.

A. Permit Information

BWP SW 23

Comprehensive Site Assessment (CSA)

1. Permit Code: 7 or 8 character code from permit instructions

2. Name of Permit Category

Interim Comprehensive Site Assessment Report for the Old Amherst Landfill, Amherst, MA.

3. Type of Project or Activity

B. Applicant Information - Firm or Individual

Amherst Department of Public Works

1. Name of Firm - Or, if party needing this approval is an individual enter name below:

2. Last Name of Individual

3. First Name of Individual

4. MI

586 South Pleasant Street

5. Street Address

Amherst

MA

01002

(413) 256-4050

6. City/Town

7. State

8. Zip Code

9. Telephone #

10. Ext. #

Guilford Mooring, P.E.

GMooring@Town.Amherst.MA.US

11. Contact Person

12. e-mail address (optional)

C. Facility, Site or Individual Requiring Approval

Old Amherst Landfill

1. Name of Facility, Site Or Individual

Belchertown Road (Route 9) - South Side

2. Street Address

Amherst

MA

01002

3. City/Town

4. State

5. Zip Code

6. Telephone #

7. Ext. #

SLF# 06-008-001

8. DEP Facility Number (if Known)

9. Federal I.D. Number (if Known)

10. BWSC Tracking # (if Known)

D. Application Prepared by (if different from Section B)*

Tighe & Bond, Inc.

1. Name of Firm Or Individual

53 Southampton Road

2. Address

Westfield

MA

01085

(413) 562-1600

3. City/Town

4. State

5. Zip Code

6. Telephone #

7. Ext. #

Jeffery J. Thelen, P.G.

8. Contact Person

9. LSP Number (BWSC Permits only)

E. Permit - Project Coordination

1. Is this project subject to MEPA review? ☐ yes ☒ no
If yes, enter the project's EOEA file number - assigned when an Environmental Notification Form is submitted to the MEPA unit:

EOEA File Number

F. Amount Due

DEP Use Only

Special Provisions:

1. ☒ Fee Exempt (city, town or municipal housing authority)(state agency if fee is \$100 or less).
There are no fee exemptions for BWSC permits, regardless of applicant status.
2. ☐ Hardship Request - payment extensions according to 310 CMR 4.04(3)(c).
3. ☐ Alternative Schedule Project (according to 310 CMR 4.05 and 4.10).
4. ☐ Homeowner (according to 310 CMR 4.02).

Permit No:

Rec'd Date:

Reviewer:

Check Number

Dollar Amount

Date



Massachusetts Department of Environmental Protection
Bureau of Waste Prevention – Solid Waste Management

BWP SW 12 Initial Site Assessment

BWP SW 23 Comprehensive Site Assessment

BWP SW 24 Corrective Action Alternative Analysis

BWP SW 25 Corrective Action Design

Application for Landfill Assessment and Closure

W 072576

Transmittal Number

SLF# 06-008-001

Facility ID# (if known)

A. BWP SW 12 Initial Site Assessment (310 CMR 19.150(4))

Important:
When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Directions:
Specify the report/plan and page numbers in which the following information is located.

	Plan/Report #	Page #	DEP Use Only
1. Initial Site Assessment (310 CMR 19.150(4))			
a. Background information			
b. Historical Research			
c. Literature/Data Search			
d. Hydrogeological Description			
e. Site Visit			
f. Mapping			
g. Field Screening			
2. Comprehensive Site Assessment Scope of Work			
3. Funding			
a. Corrective action and/or closure-post closure cost estimate			
b. Funding mechanism and schedule			

B. BWP SW 23 Comprehensive Site Assessment {310 CMR 19.150(5)}

	Plan/Report #	Page #	DEP Use Only
a. ISA Summary	CSA Report	Section 1	
b. Mapping	CSA Report	Section 2	
c. Drilling Program	CSA Report	Sections 2 & 4	
d. Determination of Hydraulic Conductivity	Not Applicable		
e. Sampling and Analysis Plan	CSA Report	Section 3	
f. Health and Safety Plan	CSA Report	Appendix F	
g. Project Schedule	Not Applicable		



Massachusetts Department of Environmental Protection
Bureau of Waste Prevention – Solid Waste Management

BWP SW 12 Initial Site Assessment
BWP SW 23 Comprehensive Site Assessment
BWP SW 24 Corrective Action Alternative Analysis
BWP SW 25 Corrective Action Design
Application for Landfill Assessment and Closure

W 072576
Transmittal Number
SLF# 06-008-001
Facility ID# (if known)

B. BWP SW 23 Comprehensive Site Assessment {310 CMR 19.150(5)}(cont.)

	Plan/Report #	Page #	DEP Use Only
h. Baseline Risk Assessment	<u>Not Applicable</u>	<u> </u>	<u> </u>
i. Corrective Action Alternative Analysis Scope of Work Outline	<u>Not Applicable</u>	<u> </u>	<u> </u>

C. BWP SW 24 Corrective Action Alternative Analysis {310 CMR 19.150(6)}

	Plan/Report #	Page #	DEP Use Only
a. Corrective Action Objectives	<u> </u>	<u> </u>	<u> </u>
b. Alternatives Analysis	<u> </u>	<u> </u>	<u> </u>
c. Recommended Alternative	<u> </u>	<u> </u>	<u> </u>

D. BWP SW 25 Corrective Action Design {310 CMR 19.151(2)(a)}

	Plan/Report #	Page #	DEP Use Only
a. Corrective Action Design and/or closure plans	<u> </u>	<u> </u>	<u> </u>
b. Implementation schedule	<u> </u>	<u> </u>	<u> </u>

E. Post Closure Plans

Note: Part E is only applicable when a closure plan has been submitted and closure is being implemented.

	Plan/Report #	Page #	DEP Use Only
1. Maintenance Plan {310 CMR 19.142(5)}	<u> </u>	<u> </u>	<u> </u>
2. Monitoring Plan {310 CMR 19.142(5)}	<u> </u>	<u> </u>	<u> </u>
3. Post-Closure Use Plans {310 CMR 19.143} (if applicable)	<u> </u>	<u> </u>	<u> </u>
4. Record Notice of Landfill Operation {310 CMR 19.141}	<u> </u>	<u> </u>	<u> </u>



Massachusetts Department of Environmental Protection
Bureau of Waste Prevention – Solid Waste Management

BWP SW 12 Initial Site Assessment
BWP SW 23 Comprehensive Site Assessment
BWP SW 24 Corrective Action Alternative Analysis
BWP SW 25 Corrective Action Design
Application for Landfill Assessment and Closure

W 072576

Transmittal Number

SLF# 06-008-001

Facility ID# (if known)

F. Certification {310 CMR 19.011}

Any person, required by these regulations or any order issued by the Department, to submit papers shall identify themselves by name, profession, and relationship to the applicant and legal interest in the facility, and make the following certification: "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties both civil and criminal for submitting false information including possible fines and imprisonment."

Michael R. Parsons, P.E.

Print Name

Michael R. Parsons

Authorized Signature

Executive Vice President

Position/Title

1/23/06

Date

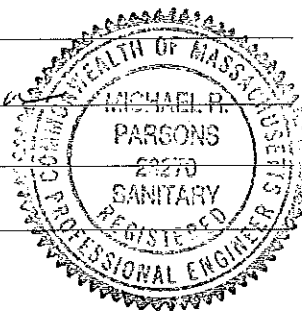


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Tighe&Bond

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BWP SW 23 PERMIT APPLICATION

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Appendix B	Mapping
Appendix C	Boring & Well Construction Logs
Appendix D	Geotechnical Data Report
Appendix E	Laboratory Data Reports
Appendix F	Health & Safety Plan

The Town of Amherst retained Tighe & Bond to evaluate and characterize existing conditions at the closed Old Amherst Landfill site located on Old Belchertown Road (Route 9) in Amherst Massachusetts. The landfill site is currently maintained as open space and is unused by the Town with the exception of snow storage during winter months.

The landfill consists of three (3) distinct waste disposal areas, a municipal solid waste (MSW) disposal area, a concrete and masonry demolition disposal area, and a wood and stump dump area. The MSW disposal area occupies the northern third of the site. The concrete and masonry demolition disposal area occupies the eastern quarter of the site. The wood and stump dump area occupies about a fifth of the southern portion of the site. All waste disposal areas were closed and capped in 1986 using a variable depth clay soil barrier system (landfill cap or final cover system). Since that time, MDEP landfill cover system requirements have become more stringent as part of an effort to protect the environment and mitigate groundwater contamination typically associated with unlined waste disposal areas.

The 1986 clay soil barrier system was a variable depth final cover system consisting of:

- vegetative cover; turf grasses and wildflower mixture
- top soil, minimum 2-inch depth
- gravel drainage layer, minimum 4-inch depth
- clay layer; minimum 6-inch depth
- gravel grading layer; variable depth
- existing cover material; variable depth

Locus and GIS-based site plans are provided in Appendix B that show the general relation of the site to the surrounding area.

1.1 SCOPE OF STUDY

The Comprehensive Site Assessment (CSA) is the second phase of the three landfill assessment phases outlined in the Massachusetts Department of Environmental Protection (MDEP) *Landfill Technical Guidance Manual, Revised May 1997*. The MDEP requires assessment of landfill sites to identify and address any potential site impacts to human health, public safety or the environment. The assessments are required under *Massachusetts Solid Waste Regulations 310 CMR 19.150(3) Landfill Assessment Requirements*.

The CSA study consists of an investigation that is intended to characterize the potential impact of the landfill on public health, safety and the surrounding environment. The CSA is a site specific investigation that typically includes detailed site mapping, installation of groundwater monitoring wells, assessment of groundwater and surface water quality, installation of gas monitoring probes or wells, assessment of any potential off-site subsurface gas migration, characterization of site hydrogeology, determination of potential contaminant migration pathways, identification of principle "contaminants of concern (COCs)", evaluation of the potential risk to human health, public safety and the environment, study conclusions and recommendations, and a recommended Scope-of-Work for the third phase of assessment entitled the Corrective Action Alternatives Analysis (CAAA).

1.2 CSA SCOPE OF WORK

The MDEP outlined the CSA scope of work in the *July 6, 2005 Initial Site Assessment (ISA) Permit Approval*. The CSA is to be completed in two phases. The first phase involves the completion of an Interim CSA Report based primarily on the collection of environmental monitoring data from existing groundwater monitoring and test wells, surface water and sediment stations, perimeter soil gas assessment and evaluation of landfill cover. The permit approval is provided in Appendix A.

The MDEP modified the scope in correspondence dated October 27, 2005 relative to the number and location of groundwater monitoring and test wells to be sampled, the number and location of surface water and sediment samples to be collected, and the location of perimeter gas monitoring wells to be installed. The revised CSA Scope Modification approval is also provided in Appendix A.

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2.1 UPDATED SITE MAPPING

Site plans prepared for the CSA were developed from Town of Amherst aerial and GIS mapping provided on October 19, 2003 to Tighe & Bond. The GIS mapping includes two-foot contour intervals, property lines, wetlands and surface water resources. Groundwater monitoring and test wells, and perimeter gas monitoring wells were surveyed by Town Engineering Department staff in January 2005. Site air monitoring stations were located using Global Positioning System (GPS) surveys and field measurements by Tighe & Bond in September 2005.

The following plans have been prepared for the CSA study and are provided in Appendix B:

- *Site Base Plan (Sheet 1 of 3)* - The CSA Site Base Plan has been prepared at a scale of 1"=200' and includes groundwater and soil gas monitoring well locations, water supply test well locations, surface water and sediment sample stations, property lines, structures, wetland and surface water resource boundaries.
- *Site Orthophoto Plan (Sheet 2 of 3)* - The Site Orthophoto Plan has been prepared at a scale of 1"=100' to show detail at the landfill site. The plan includes perimeter gas monitoring wells, soil gas monitoring points, surface water stations, air monitoring stations and test hole locations across the site.
- *Nov-05 Groundwater Contour Plan (Sheet 2 of 3)* - This plan has been prepared at a scale of 1"=200' and is based on groundwater elevation data collected on November 10, 2005 and estimated surface water elevations. The plan includes groundwater elevation contours for both the surficial aquifer and groundwater flow directions downgradient of the landfill site.

2.2 DRILLING PROGRAM

Seven perimeter gas monitoring wells were installed for the Interim CSA study to characterize subsurface gas migration and migration pathways on the perimeter of the waste disposal areas. These gas monitoring wells were installed to a depth of 5 feet into the groundwater table, or to a maximum depth of 50 feet below grade. The exception is well PGW-6 which was installed to a depth of 88 feet and installed 10 feet into the groundwater table to allow groundwater sample collection at a location immediately downgradient of the MSW portion of the landfill. Gas monitoring well locations are shown on the Interim CSA site plans.

Seaboard Geotechnical and Environmental Drilling Services (Seaboard) was contracted to install the perimeter gas monitoring wells. Drilling activities were conducted in September 2005 and witnessed by a Tighe & Bond, Inc. environmental scientist.

2.2.1 Drilling Method

Gas monitoring wells (PGW-1 through PGW-7) were installed using a standard 4.25 inch inside diameter hollow stem augers (HSA).

Hollow-stem auger (HSA) drilling methods involve the rotary advancement of 5-foot lengths of HSA casing into the ground. A "rod plug" is typically used at the auger cutting head below grade to minimize the accumulation of soils within the HSA casing. Monitoring wells were installed within the open HSA casing once a boring was completed. The HSA casing is slowly extracted as the well is constructed, backfilled and completed.

2.2.1.1 Soil Sampling Procedures

Soil samples were collected during monitoring well installation using split spoon samplers in accordance with ASTM method D1586-99 for Standard Penetration Tests (SPTs). Soil samples were collected at each location in 2-foot increments at 5-foot intervals. Recovered soils were classified and described in the field using the Burmister System; and recorded on the boring logs provided in Appendix C. Portions of each soil sample were retained and jarred for soil headspace screening.

2.2.1.2 PID Headspace Soil Screening

A portion of each soil sample was placed in a clean glass jar and screened for the presence of volatile organic compounds (VOCs) using a 10.2 eV photoionization detector (PID). The soil screening was performed in general accordance with methods described in Appendix A of MDEP Policy #WSC-402-96. Soil headspace screening results are reported on the boring logs provided in Appendix C.

With the exception of boring B01-05, all samples were non-detect for VOCs. Boring B01-05 was installed at the landfill entrance gate on the western side where well PGW-2 was originally staked. The boring encountered landfill waste materials and was abandoned. Trace levels of VOCs were detected in samples collected between 10 to 12 feet (0.8 ppm), 15 to 17 feet (13.2 ppm), 20 to 22 feet (6.8 ppm) and 30 to 32 feet (0.3 ppm) below grade. Boring B01-05 was backfilled with drilling spoils and sealed just below the ground surface with bentonite clay.

2.2.1.3 Disposal of Drilling Spoils

Drilling cuttings consisting of soil removed from the borehole were collected and deposited in the vicinity of the monitoring well locations at the landfill site. Other than the B01-05 location, waste materials were not encountered. All perimeter gas monitoring wells were installed beyond the limit of waste disposal at the site.

2.2.1.4 Equipment Decontamination

Drilling equipment was decontaminated between boring locations by removing gross contamination such as soil cuttings (at the drilling site), followed by pressure washing and steam cleaning. Drilling equipment was cleaned at a decontamination pad that was set up at the nearby lined Amherst Landfill and Transfer Station.

2.2.1.5 Borehole Abandonment

With the exception of boring B01-05 that was abandoned due to encountering waste materials, all borings were completed as gas monitoring wells for this phase of the study. The abandoned bore hole at the B01-05 location was backfilled with drilling spoils and sealed with bentonite clay just below the ground surface.

2.2.2 Monitoring Well Installation

The seven perimeter gas monitoring wells were installed in accordance with the standard procedures for monitoring well installation as described in *MDEP Publication WSC-310-91, Standard References for Monitoring Wells*. In summary, monitoring wells were completed with 2-inch diameter; Schedule 40, PVC riser and various lengths of 0.010-inch slotted well screen with flush-joint threads. No glues or additives were used during the installation. Clean washed No. 2 sand was backfilled around and two feet above the screen with a bentonite seal placed above the sand.

Gas monitoring wells were installed a minimum of 5 feet into the groundwater table and screened throughout the vadose zone to a depth of five feet below grade, or to a maximum depth of 50 feet below grade. The exception is well PGW-6 that was installed to a depth of 88 feet and installed 10 feet into the groundwater table to allow groundwater sample collection at a location immediately downgradient of a portion of the MSW landfill where the Town reported that several solvent and paint containing drums were encountered during the 1970s, then relocated to other portions of the site.

For all monitoring wells, riser pipes were extended 2 to 3 feet above grade and equipped with a locking protective steel casing cemented at the surface. Each well was also provided with a 2 inch diameter expansion cap on the PVC pipe.

2.2.3 Boring & Well Installation Logs

Boring logs prepared by Seaboard Geotechnical and Environmental Drilling Services (Seaboard) are provided in Appendix C. The boring logs include Burmister system soil descriptions, SPT data, approximate depth of groundwater, PID headspace screening results, and well construction details.

2.3 FIELD SURVEY

Survey for the Interim CSA Report was completed as follows:

2.3.1 GPS Survey

Prior to starting the field work for the Interim CSA study, Tighe & Bond conducted a GPS field survey to set out a 100-foot grid at the site for both the ambient air monitoring and the landfill cover test hole evaluation. This grid is shown on the *1"=100' Site Orthophoto Plan* provided in Appendix B. Stakes were set at each grid node along with a station number identification. A total of 209 grid stations were established across the 40 acre site. The GPS survey was conducted in September 2005.

Test hole locations were identified on the grid stakes based on a one test hole per acre sampling frequency. A total of 43 grid stakes were field identified for cover soil test hole evaluation.

2.3.2 Site Survey

Following the completion of field work for the study, the Town Engineering Department conducted ground survey to locate the perimeter gas monitoring wells and other wells used for the study. Vertical elevations were also established for ground, top of casing and top of PVC well casing for each well, as applicable. The well survey was used to determine groundwater elevations and flow directions at and downgradient of the site.

Surface water and sediment stations were not surveyed for the study. Those locations could be readily located using the existing Town orthophoto mapping and field observations.

2.4 CAP "TEST HOLE" EVALUATION

Condition #12 of the Interim CSA scope of work outlined by MDEP ISA Approval correspondence required the performance of shallow borings through the landfill cover soils and barrier layer at a spacing of 1 boring per acre, excluding the Phase I MSW "Mound" area. The shallow borings were installed to provide the following data:

- 1) characterize the type and depth of cover soils;
- 2) provide soil gas monitoring data of the soil air space in the boring prior to penetration of the barrier layer soil, monitored for combustible gas (% LEL methane), % oxygen, hydrogen sulfide gas concentration and total VOC concentration;
- 3) collect five representative soil samples of the barrier layer soil and analyze the soil for hydraulic conductivity (permeability) by the tri-axial cell method;
- 4) collect five representative soil samples of the landfill cover soils (topsoil layer) and analyze the soils for total RCRA 8 metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag) and volatile organic compounds (VOCs) using EPA Method 8260;
- 5) collect two soil samples from the former sand pit just south of the landfill and the area between the landfill and Pomeroy Pond; and analyze the soils for total RCRA 8 metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag) and volatile organic compounds (VOCs) using EPA Method 8260.

2.4.1 Landfill Cover Characterization

A total of 43 test holes were installed at the landfill in cover soils using either a soil auger, shovel, post hole digger or drilling rig with 4.25 inch ID HSA. Test hole locations are shown on the *1"=100' Site Orthophoto Plan* provided in Appendix B. Results of the landfill cover soil evaluation are summarized in Table 2.1 attached at the end of this Section.

Cover soils consisted of 7 inches to 15 inches of topsoil consisting of light to dark very fine sand with trace amounts of silt; overlying 5 inches to 12 inches of compacted grey silt clay. Test holes located off the landfill (as best determined by location along the perimeter of the site) lacked the barrier soil.

2.4.2 Test Hole - Soil Gas Data

Test hole soil gas data is provided on Table 2.1. Each test pole was monitored for combustible gas (% LEL methane), % oxygen, hydrogen sulfide gas concentration (in parts per million or ppm), and total VOC concentration.

Samples of soil gas were monitored at each test hole using a MultiRAE 4 gas meter; equipped with a photoionization detector (PID) for VOC screening. Monitoring was conducted by checking the air space of the test hole prior to penetration of the cap barrier layer, where encountered. Test hole soil gas monitoring results indicate that no combustible gas was detected in any of the test holes. Oxygen levels were equivalent to

site background conditions. No hydrogen sulfide (H₂S) gas was detected at a detection level of 1 ppm. Soil gas VOC levels were less than 1 ppm.

2.4.3 Barrier Layer Characterization

Six barrier layer samples were collected and analyzed for saturated hydraulic conductivity by ASTM Method D5084. Samples were collected on November 17, 2005 by STL, a subcontractor to Tighe & Bond, by hand excavation using a shovel. Sample collection may have been somewhat compromised by heavy rainfall that caused seepage of water into the test holes. Test results are summarized in Table 2.2 attached at the end of this Section.

Soils were characterized at the test laboratory as yellowish brown to brown silty sand. Reported hydraulic conductivity values for the barrier layer varied from 3.4×10^{-4} cm/s to 2.7×10^{-6} cm/s. The average hydraulic conductivity calculated for the six samples was 1.5×10^{-4} cm/s with a median value of 1.1×10^{-4} cm/s.

2.4.4 Chemical Analysis of Landfill & Other Cover Soils

Landfill cover soils (topsoil samples from the 0-6 inch depth) were analyzed for total RCRA 8 metals and volatile organic compounds (VOCs) via EPA Method 8260. Analytical results are summarized in Table 2.3 for RCRA 8 metals and Table 2.4 for VOCs, respectively. Sample locations were selected following test hole soil air and barrier layer characterization and confirmed with the MDEP prior to sampling.

2.4.4.1 RCRA 8 Metals

For the RCRA 8 metals data, analytical results are compared to USGS Range & Mean soils data, Draft MDEP Non-Urban Background Soil Concentrations and MDEP Massachusetts Contingency Plan (MCP) Reporting Category (RC) S-1 soil guidelines for playground, recreational areas and drinking water supply resource areas. The MDEP MCP RC S-1 soil guidelines are the most applicable for the potential future use of the site.

Metals analysis indicated all RCRA 8 metals were below MDEP MCP RC S-1 soil guidance levels. The metals cadmium (Cd), mercury (Hg), selenium (Se) and silver (Ag) were below analytical method reporting levels. Low levels of arsenic (As) were detected in six samples at levels varying from 2 mg/kg to 11 mg/kg. Barium (Ba) was detected at concentrations ranging from 21 mg/kg to 49 mg/kg. Chromium (Cr) was detected at levels ranging from 8 mg/kg to 17 mg/kg. Lead (Pb) was detected at concentrations ranging from 6 mg/kg to 20 mg/kg.

2.4.4.2 VOC Analysis

VOC analysis by EPA Method 8260 did not detect any of the target analytes in the eight samples analyzed. However, the non-target compound hexanal was detected in each sample at estimated concentrations ranging from 2.0 ug/kg to 14.9 ug/kg. Additional non-target compounds octanal and pentanal were also detected in single soil samples at estimated concentrations of 2.1 ug/kg and 2.0 ug/kg, respectively.

Discussions with the STL laboratory director indicate that these compounds may be artifacts of the “dry” preservation technique used on the samples that uses sodium bisulfate. The sodium bisulfate may react with organic matter in soil samples and generate these types of compounds. The levels were all very low, less than 15 ug/kg (ppb). The laboratory method blank was clean.

2.5 AMBIENT AIR SURVEY

Ambient air monitoring was conducted on September 20, 2005 in accordance with Condition #11 of the MDEP Interim CSA scope of work outlined by MDEP ISA Approval correspondence. Ambient air measurements were taken at an interval of 5 per acre across the site using the 100-foot staked grid. Air samples were taken at a height of 5 feet above the ground surface and analyzed using field monitoring equipment for percent Lower Explosion Limit (LEL) for methane, percent oxygen, hydrogen sulfide gas in parts per million (ppm), and total volatile organic compounds (VOCs) using a 10.2 eV photoionization detector (PID). Results are summarized in Table 2.5 at the end of this Section.

Air monitoring did not detect the presence of landfill gases at the site in the ambient air. Methane or other combustible gases were not detected. Oxygen levels varied little across the site, varying from 22.9% to 23.0% as reported. Hydrogen sulfide gas was not detected in at any of the stations. Total VOCs by PID scan were also not detected.

2.6 PERIMETER SOIL GAS ASSESSMENT

Soil gas monitoring was conducted on October 11, 2005 along the perimeter of the site as required under Condition #10 of the MDEP Interim CSA scope of work outlined by MDEP ISA Approval correspondence. Soil gas was monitored at each of the seven new gas monitoring wells installed for this study and all existing perimeter soil gas points previously installed at the site, and at four existing gas vents located on the MSW “mound” area of the site. Gas monitoring was conducted using a LandTec GA-90 infrared gas analyzer capable of measuring percent methane (CH₄), percent LEL (as methane), percent carbon dioxide (CO₂), percent oxygen (O₂) and atmospheric pressure in inches of mercury (Hg). Gas measurements for hydrogen sulfide (H₂S), carbon monoxide and total VOCs by PID in parts per million (ppm) were taken using a MultiRAE 5-gas meter. The data is presented in Table 2.6 at the end of this Section.

Soil gas monitoring detected elevated levels of methane in the subsurface on the northern portion of the western property boundary at soil gas points SG-21 0+00 and SG-22 0+00; at concentrations of 48.1% and 28.4%, respectively. These levels exceed 100% of the LEL for methane. Soil gas monitoring conducted at points SG-21 0+50 and SG-22 0+50, located 50 feet off the 0+00 points did not detect any methane in the subsurface. The 0+00 points at these two locations are actually on Town property following the acquisition of a "wedge" shaped parcel that is shown on the site mapping prepared for this study. This data was reported to the MDEP with 24 hours as required *under Massachusetts Solid Waste Regulations 310 CMR 19.132(4)(h)*.

Other than SG-21 0+00 and SG-22 0+00, no methane was detected at the remaining soil gas points, new gas monitoring wells or landfill gas vents monitored for the study. Carbon dioxide gas levels varied in the soil air from 0.0% to 27.4%, and were highest at the two soil gas points where methane was detected. Oxygen levels in the soil air varied from 0.0% to 20.9% (background level), and were lowest at the two soil gas points where methane was detected. Neither hydrogen sulfide gas, carbon monoxide gas nor total VOCs by PID screening were detected in the soil gas.

2.7 GROUNDWATER CONTOUR PLAN

Site groundwater elevations were measured twice for the Interim CSA Study, once during soil gas monitoring on October 11, 2005 and again during groundwater sampling on the dates of November 10, 11 and 18, 2005 for various wells. Groundwater elevation data is summarized on Table 2.7. This table also includes information on well depth, screen depth, screen length and characterization of the screened aquifer unit taken from boring and well installation logs.

Groundwater elevation data collected in November during groundwater sample collection were used to construct the *Nov-05 Groundwater Contour Plan* provided in Appendix A. Due to the lack of sufficient groundwater elevations from monitoring wells or test wells to clearly define groundwater table conditions downgradient of the site, surface water and wetland spot elevations were estimated and used to complete the groundwater contour mapping.

The November 2005 groundwater contours show an overall western groundwater gradient and flow direction across the site. The groundwater flow direction is also projected to the west, north and south of the site. Based on this mapping, groundwater flow from the landfill is not projected to the south of monitoring well #1-03. The groundwater table gradient is steepest at the landfill site adjacent to Pomeroy Pond between gas monitoring wells PGW-4 and PGW-5, flattening to the west of gas monitoring well PGW-6.

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TABLE 2.1 - Landfill Test Hole Data
Old Amherst Landfill
Belchertown Road (Route 9), Amherst, MA
Data collected September 20, 21 and 27, 2005

Station ID	Depth (inches)	Soil Description	% LEL	%O2	H2S (ppm)	PID - VOCs (ppm)
1	Ground Cover	6 - 8" Grass and weeds				
	0-3"	Dark brown very fine sand, trace silt, trace small gravel				
	3-6"	Dark brown very fine sand, trace silt				
	6-12"	Dark brown very fine sand, trace silt				
	12-15"	Light brown/yellow very fine sand, trace silt	0	22.5	0	0.2
	15-24"	Grey silt and clay (dry)				
6	Ground Cover	8-10" Grass and weeds				
	0-4"	Dark brown very fine sand, trace silt, trace small gravel				
	4-11"	Dark brown very fine sand, trace silt				
	11-13"	Light brown very fine sand, trace silt	0	22.6	0	0
	13-24"	Grey clay and silt (moist)				
9	Ground Cover	6-8" Grass and weeds				
	0-8"	Dark brown very fine sand, trace silt				
	8-13"	Light brown/yellow very fine sand, trace silt	0	22.6	0	0
	13-23"	Grey silt and clay (dry)				
	23-25"	Light brown very fine sand, trace silt				
14	Ground Cover	8-10" Grass and weeds				
	0-5"	Dark brown very fine sand, trace silt				
	5-12"	Light brown very fine sand, trace silt				
	12-24"	Light grey silt and clay (dry)	0	21.8	0	0.4
	24-25"	Dark grey very fine sand and trace silt				
19	Ground Cover	8-10" Grass and weeds				
	0-6"	Dark brown very fine sand, trace silt				
	6-13"	Light brown very fine sand, trace silt	0	22.6	0	0
	13-21"	Grey clayey silt (dry)				
	21-36"	Light brown very fine sand, trace silt				
25	Ground Cover	6-8" Grass and weeds				
	0-6"	Dark brown very fine sand, trace silt				
	6-12"	Light brown very fine sand, trace silt	0	22.7	0	0.3
	12-19"	Grey clayey silt (dry)				
	21-36"	Light brown very fine sand, trace silt				
30	Ground Cover	6-8" Grass and weeds				
	0-6"	Dark brown very fine sand, trace silt				
	6-12"	Light brown very fine sand, trace silt	0	22.6	0	0.5
	12-17"	Grey silt and clay (dry)				
	17-25"	Light brown fine sand, trace silt				
33	Ground Cover	8-18" Grass and weeds				
	0-10"	Dark brown very fine sand, trace silt, trace small gravel				
	10-15"	Light brown very fine sand, trace silt	0	22.7	0	0
	15-24"	Grey clay and silt (moist)				
38	Ground Cover	6-8" Grass and weeds				
	0-6"	Dark brown very fine sand, trace silt				
	6-12"	Light brown very fine sand, trace silt	0	22.8	0	0
	12-24"	Grey silt and clay (dry)				
	24-28"	Light brown fine to medium sand, trace silt, trace small gravel				
42	Ground Cover	6-8" Grass and weeds				
	0-6"	Brown very fine sand, trace silt				
	6-12"	Light brown/orange very fine sand, trace silt	0	22.8	0	0
	12-24"	Clayey silt, some very fine sand				
	24-28"	Brown very fine sand, trace silt				

TABLE 2.1 - Landfill Test Hole Data
Old Amherst Landfill
Belchertown Road (Route 9), Amherst, MA
Data collected September 20, 21 and 27, 2005

47	Ground Cover	6-12" Grass and weeds				
	0-6"	Dark brown very fine sand, trace silt				
	6-12"	Light brown very fine sand, trace silt	0	22.6	0	0
	12-21"	Grey silt and clay (dry)				
	21-24"	Light brown very fine sand, trace silt				
52	Ground Cover	6-8" Grass and weeds				
	0-6"	Brown very fine sand, trace silt				
	6-12"	Light brown very fine sand, trace silt	0	22.9	0	0
	12-17"	Light brown fine sand, some clayey silt (dry)				
	17-24"	Light brown very fine sand, trace silt				
57	Ground Cover	6-10" Grass and weeds				
	0-6"	Brown very fine sand, trace silt				
	6-12"	Light brown very fine sand, trace silt	0	22.9	0	0
	12-19"	Grey silt and clay, trace fine sand (dry)				
	19-24"	Light brown fine sand, trace silt				
62	Ground Cover	6-8" Grass and weeds				
	0-8"	Light brown very fine sand, trace silt	0	22.6	0	0
	8-15"	Grey clayey silt (dry)				
	15-19"	Light brown very fine sand, trace silt				
68	Ground Cover	6-8" Grass and weeds				
	0-6"	Brown very fine sand, trace silt				
	6-12"	Light brown/orange very fine sand, trace silt	0	22.8	0	0
	12-20"	Silt and clay, trace fine sand (dry)				
	2-26"	Light brown fine sand, trace silt				
73	Ground Cover	6-8" Grass and weeds				
	0-6"	Brown very fine sand, trace silt				
	6-15"	Light brown very fine sand, trace silt	0	22.7	0	0
	15-27"	Grey clay and silt (moist)				
	27-32	Light brown fine sand				
78	Ground Cover	6-8" Grass and weeds				
	0-6"	Brown very fine sand, trace silt				
	6-12"	Light brown very fine sand, trace silt	0	22.8	0	0
	12-17"	Fine sand, some clayey silt (dry)				
80	Ground Cover	6-8" Grass and weeds				
	0-8"	Brown very fine sand, trace silt				
	8-14"	Light brown very fine sand, trace silt	0	22.9	0	0
	14-22"	Light brown sand, some clayey silt				
	22-28"	Light brown/yellow very fine sand, trace silt				
85	Ground Cover	8-10" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-11"	Light brown very fine sand, trace silt	0	22.6	0	0
	11-18"	Grey silt and clay (dry)				
	18-26"	Light brown very fine to medium sand, trace silt				
90	Ground Cover	8-12" Grass and weeds				
	0-4"	Dark brown very fine sand, trace silt				
	4-7"	Light brown very fine sand, trace silt	0	22.8	0	0
	7-12"	Light brown fine sand, some clayey silt (dry)				
	12-24"	Light brown fine sand, trace silt				
97	Ground Cover	8-10" Grass and weeds				
	0-8"	Brown very fine sand, trace silt				
	8-15"	Light brown very fine sand, trace silt	0	22.7	0	0
	15-19"	Grey clay and silt (moist)				
	19-26"	Grey fine to medium sand, trace silt				

TABLE 2.1 - Landfill Test Hole Data
Old Amherst Landfill
Belchertown Road (Route 9), Amherst, MA
Data collected September 20, 21 and 27, 2005

102	Ground Cover	6-8" Grass and weeds				
	0-6"	Dark brown very fine sand, trace silt				
	6-12"	Light brown very fine sand, trace silt	0	22.9	0	0
	12-18"	Clayey silt, trace fine sand				
	18-24"	Light brown fine sand, trace small gravel				
109	Ground Cover	6-10" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-12"	Light brown very fine sand, trace silt	0	22.6	0	0
	12-18"	Light brown very fine sand, some clayey silt (dry)				
	18-30"	Brown fine to medium sand, trace small gravel, trace glass				
114	Ground Cover	6-8" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-9"	Light brown very fine sand, trace silt	0	22.7	0	0
	9-15"	Light brown very fine sand, and clayey silt				
	15-24"	Brown fine sand, trace silt, trace brick and glass				
116	Ground Cover	6-8" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-12"	Grey fine sand trace silt, trace clay	0	22.6	0	0
	12-18"	Brown fine sand, trace silt, trace small gravel				
	18-24"	Light brown fine sand, trace small gravel				
121	Ground Cover	6-8" Grass and weeds				
	0-5"	Brown very fine sand, trace silt				
	5-9"	Light brown very fine sand, trace silt	0	22.7	0	0
	9-18"	Light brown very fine sand and clayey silt (dry)				
	18-24"	Brown fine sand, trace silt, trace glass				
128	Ground Cover	6-8" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-9"	Light brown very fine sand, trace silt	0	22.7	0	0
	9-15"	Grey clayey silt (dry)				
	15-24"	Brown fine sand, trace silt				
136	Ground Cover	4-6" Grass and weeds				
	0-5"	Brown very fine sand, trace silt				
	5-8"	Light brown very fine sand, trace silt	0	22.8	0	0
	8-15"	Light brown very fine sand and clayey silt (dry)				
	15-24"	Brown very fine sand, trace silt				
141	Ground Cover	6-8" Grass and weeds				
	0-5"	Brown very fine sand, trace silt				
	5-9"	Light brown very fine sand, trace silt	0	22.7	0	0
	9-15"	Light brown very fine sand and clayey silt (dry)				
	15-24"	Light brown fine sand, trace silt				
144	Ground Cover	4" Grass				
	0-8"	Brown very fine sand, trace silt	0	22.8	0	0
	8-12"	Light brown/yellow fine sand, trace silt (dry)				
	12-24"	Light brown fine to medium sand, trace silt, trace small gravel				
149	Ground Cover	4-8 " Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-9"	Light brown very fine sand, trace silt				
	9-15"	Light brown very fine sand and clayey silt (dry)				
	15-24"	Brown fine sand, trace silt				

TABLE 2.1 - Landfill Test Hole Data
Old Amherst Landfill
Belchertown Road (Route 9), Amherst, MA
Data collected September 20, 21 and 27, 2005

156	Ground Cover	6-8" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-9"	Light brown very fine sand, trace silt	0	22.6	0	0
	9-15"	Grey light brown clayey silt (dry)				
	15-20"	Brown fine to medium sand, trace silt				
	20-24"	Brown fine to medium sand, trace silt, trace wood debris				
163	Ground Cover	6-8" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-10"	Light brown very fine sand, trace silt	0	22.6	0	0
	10-15"	Grey/ light brown very fine sand and clayey silt (dry)				
	15-24"	Light brown fine sand, trace silt				
168	Ground Cover	8-10" Grass and weeds				
	0-26"	Brown very fine sand, trace silt, some small gravel	0	22.9	0	0
169	Ground Cover	8-10" Grass and weeds				
	0-5"	Brown very fine sand, trace silt				
	5-11"	Light brown very fine sand, trace silt	0	22.6	0	0
	11-16"	Grey fine sand, some clayey silt (dry)				
	16-26"	Brown fine sand, trace clay, trace tar, trace glass				
174	Ground Cover	4-6" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-9"	Light brown very fine sand, trace silt	0	22.7	0	0
	9-16"	Light brown very fine sand and clayey silt (dry)				
	16-24"	Light brown fine to coarse sand, trace silt				
	24-28"	Land fill debris				
179	Ground Cover	6-8" Grass and weeds				
	0-4"	Brown very fine sand, trace silt				
	4-8"	Light brown very fine sand, trace silt, trace small gravel	0	22.6	0	0
	8-13"	Light brown very fine sand, trace silt				
	13-18"	Brown fine sand, trace silt				
	18-24"	Light brown fine to coarse sand, trace silt				
184	Ground Cover	4-8" Grass and weeds				
	0-30"	glass fragments and evidence of urban fill	0	22.9	0	0
189	Ground Cover	4-8" Grass and weeds				
	0-36"	Light brown very fine sand, trace silt	0	22.9	0	0
193	Ground Cover	Sparse moss, clumps of 2-3" grass				
	0-30"	Light brown very fine sand, trace silt	0	22.9	0	0
197	Ground Cover	Sparse moss, and grass				
	1-42"	Light brown very fine sand, trace silt	0	22.9	0	0
205	Ground Cover	Sparse dried moss				
	0-1"	Brown very fine sand, trace silt				
	1-30"	Light brown very fine sand and clayey silt (dry)	0	22.9	0	0
207	Ground Cover	Thick moss and pine saplings				
	1-30"	Light brown very fine sand, trace silt	0	22.8	0	0

Notes:

1) % LEL, % O₂, H₂S (ppm) and PID - VOC (ppm) data collected within the test hole above the landfill cap layer.

2) Bold descriptions indicate landfill cap barrier layer characterization.

TABLE 2.2
Landfill Cap Barrier Layer - Hydraulic Conductivity Estimates
Old Amherst Landfill CSA Study

Soil Sample	Barrier Layer Depth (inches bg)	Soil Description (Geotechnical laboratory)	ASTM Method D1557		ASTM Method D5084 Hydraulic Conductivity (cm/sec)
			Maximum Dry Density (lbs./ft ³)	Optimum Content (% H ₂ O)	
Test Hole #25	12-19	Brown Silty Sand	120.0	13.0%	1.4E-04
Test Hole #102	12-18	Yellowish Brown Silty Sand	xxx	xxx	2.7E-06
Test Hole #121	9-18	Yellowish Brown Silty Sand	xxx	xxx	8.5E-05
Test Hole #136	8-15	Yellowish Brown Silty Sand	xxx	xxx	8.4E-05
Test Hole #149	9-15	Yellowish Brown Silty Sand	xxx	xxx	2.7E-04
Test Hole #163	10-15	Yellowish Brown Silty Sand	xxx	xxx	3.4E-04
Average Estimated Hydraulic Conductivity of the Cap Barrier Layer =					1.5E-04
Median Estimated Hydraulic Conductivity of the Cap Barrier Layer =					1.1E-04

Samples Collected Nov. 17, 2005. Barrier layer sample recovery may have been compromised by heavy rains causing puddling in test holes.

**Table 2.3 RCRA 8 Metals
Landfill Cover Soil Evaluation**

Surficial Soil Sample Location	Date	Percent Solids (%)	Total RCRA 8 Metals							
			Arsenic (As) (mg/kg)	Barium (Ba) (mg/kg)	Cadmium (Cd) (mg/kg)	Chromium (Cr) (mg/kg)	Lead (Pb) (mg/kg)	Mercury (Hg) (mg/kg)	Selenium (Se) (mg/kg)	Silver (Ag) (mg/kg)
Comparison Standards										
USGS Soil Data (1)	Range (ppm) Mean (ppm)		0.1 - 73	10 - 1,500		1 - 1,000	<10 - 300	0.01 - 3.4	<0.1 - 3.9	
			7.4	420		52	17	0.12	0.45	
MDEP Non-Urban Background Soil Concentrations (2)			17	45	2	29	99	0.3	0.5	0.6
MCP RCS-1 Limits (3)			30	1,000	30	1,000	300	20	400	100
Landfill Cover - Surface Soil Samples (0-6 inch Topsoil Layer)										
Station #25	21-Nov-05	76.4	<1	49	<1	9	19	<0.3	<3	<0.7
Station #102	21-Nov-05	75.5	2	21	<1	8	9	<0.3	<3	<0.7
Station #121	21-Nov-05	73.6	4	24	<1	9	11	<0.3	<3	<0.7
Station #136	21-Nov-05	74.1	11	46	<1	17	11	<0.3	<3	<0.7
Station # 142	21-Nov-05	80.7	2	26	<1	10	20	<0.2	<2	<0.6
Station # 149	21-Nov-05	76.5	2	24	<1	9	9	<0.3	<3	<0.7
Station #163	21-Nov-05	79.4	2	29	<1	12	6	<0.3	<3	<0.6
Station #193	21-Nov-05	81.0	<1	27	<1	9	6	<0.2	<2	<0.6

(1) USGS Soil Data

Range and mean data for the Eastern United States from:

"Element Concentrations in Soils and Other Surficial Materials in Conterminous United States".

H. T. Shackette & J.C. Boerngen. USGS Professional Paper 1270. US Government Printing Office, Washington, 1984.

(2) Draft MDEP background soil concentrations for non-urban (rural, suburban) locations.

(3) Massachusetts Contingency Plan (MCP) Reporting Category RCS-1: for playground, recreational areas and drinking water supply resource areas

Table 2.4 - Cover Soil VOC Data Summary
Old Amherst Landfill CSA Study

EPA METHOD 8260 Compound	MCP Method 1 Cleanup Standards (µg/kg)	Station #25	Station #102	Station #121	Station # 136	Station # 142	Station #149	Station # 163	Station # 193
		11/17/05	11/17/05	11/17/05	11/17/05	11/17/05	11/17/05	11/17/05	11/17/05
Acetone	3,000	U	U	U	U	U	U	U	U
Bromobenzene		U	U	U	U	U	U	U	U
Benzene	10,000	U	U	U	U	U	U	U	U
Bromodichloromethane	100	U	U	U	U	U	U	U	U
Bromochloromethane		U	U	U	U	U	U	U	U
Bromoform	100	U	U	U	U	U	U	U	U
Bromomethane	10,000	U	U	U	U	U	U	U	U
2-Butanone (MEK)	300	U	U	U	U	U	U	U	U
Carbon tetrachloride	1,000	U	U	U	U	U	U	U	U
Chlorobenzene	8,000	U	U	U	U	U	U	U	U
Chlorodibromomethane		U	U	U	U	U	U	U	U
Chloroethane		U	U	U	U	U	U	U	U
Chloroform	100	U	U	U	U	U	U	U	U
Chloromethane		U	U	U	U	U	U	U	U
2-Chlorotoluene		U	U	U	U	U	U	U	U
4-Chlorotoluene		U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	2,000	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	4,000	U	U	U	U	U	U	U	U
Dibromomethane		U	U	U	U	U	U	U	U
1,2-Dibromo-3-chloropropane		U	U	U	U	U	U	U	U
1,2-Dichlorobenzene	100,000	U	U	U	U	U	U	U	U
1,3-Dichlorobenzene	100,000	U	U	U	U	U	U	U	U
1,4-Dichlorobenzene	2,000	U	U	U	U	U	U	U	U
1,1-Dichloroethane	3,000	U	U	U	U	U	U	U	U
1,1-Dichloroethene	700	U	U	U	U	U	U	U	U
1,2-Dichloroethane	50	U	U	U	U	U	U	U	U
1,2-Dichloropropane	100	U	U	U	U	U	U	U	U
1,3-Dichloropropane	10	U	U	U	U	U	U	U	U
2,2-Dichloropropane		U	U	U	U	U	U	U	U
1,1-Dichloropropene		U	U	U	U	U	U	U	U
cis-1,3-Dichloropropene		U	U	U	U	U	U	U	U
trans-1,3-Dichloropropene		U	U	U	U	U	U	U	U
Ethylbenzene	80,000	U	U	U	U	U	U	U	U
Ethylene Dibromide (EDB)	5.0	U	U	U	U	U	U	U	U
Trichlorofluoromethane		U	U	U	U	U	U	U	U
2-Hexanone		U	U	U	U	U	U	U	U
Hexachlorobutadiene	3,000	U	U	U	U	U	U	U	U
Isopropylbenzene		U	U	U	U	U	U	U	U
4-Methyl-2-pentanone (MIBK)	500	U	U	U	U	U	U	U	U
Methylene chloride	100	U	U	U	U	U	U	U	U
n-Butylbenzene		U	U	U	U	U	U	U	U
n-Propylbenzene		U	U	U	U	U	U	U	U
Naphthalene	4,000	U	U	U	U	U	U	U	U
m&p-Xylene	500,000	U	U	U	U	U	U	U	U
p-Isopropyltoluene		U	U	U	U	U	U	U	U
o-Xylene	500,000	U	U	U	U	U	U	U	U
sec-Butylbenzene		U	U	U	U	U	U	U	U
Styrene	2,000	U	U	U	U	U	U	U	U
tert-Butylbenzene		U	U	U	U	U	U	U	U
Tetrachloroethene	500	U	U	U	U	U	U	U	U
1,1,1,2-Tetrachloroethane	400	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	20	U	U	U	U	U	U	U	U
Toluene	90,000	U	U	U	U	U	U	U	U
1,2,3-Trichlorobenzene		U	U	U	U	U	U	U	U
1,2,4-Trichlorobenzene	100,000	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	30,000	U	U	U	U	U	U	U	U
1,1,2-Trichloroethane	300	U	U	U	U	U	U	U	U
Trichloroethene	400	U	U	U	U	U	U	U	U
1,2,3-Trichloropropane		U	U	U	U	U	U	U	U
1,2,4-Trimethylbenzene		U	U	U	U	U	U	U	U
1,3,5-Trimethylbenzene		U	U	U	U	U	U	U	U
Vinyl Chloride	300	U	U	U	U	U	U	U	U
Methyl-tert-butyl-ether (MTBE)	300	U	U	U	U	U	U	U	U
Total Quantified VOCs		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Identified Non-Target Compounds</i>									
Hexanal		9.9	14.9	3.7	3.3	7.6	11.1	12.6	2.0
Octanal		U	U	U	U	U	2.1	U	U
Pentanal		U	2.0	U	U	U	U	U	U

U = Not Detected

**TABLE 2.5 - Landfill Site Ambient Air Readings
Old Amherst Landfill CSA**

Data Collected September 20, 2005				
Station ID #	% Lower Explosion Limit (LEL) % LEL for Methane	% Oxygen % O ₂	Hydrogen Sulfide H ₂ S (ppm)	Total VOCs - PID (ppm)
1	0.0	22.9	0	0.2
2	0.0	23.0	0	0.3
3	0.0	23.0	0	0.3
4	0.0	22.9	0	0.3
5	0.0	23.0	0	0.3
6	0.0	23.0	0	0.2
7	0.0	22.9	0	0.3
8	0.0	22.9	0	0.2
9	0.0	22.9	0	0.2
10	0.0	22.9	0	0.0
11	0.0	22.9	0	0.3
12	0.0	22.9	0	0.2
13	0.0	22.9	0	0.2
14	0.0	22.9	0	0.2
15	0.0	22.9	0	0.1
16	0.0	22.8	0	0.1
17	0.0	22.8	0	0.1
18	0.0	22.9	0	0.1
19	0.0	22.8	0	0.1
20	0.0	22.8	0	0.1
21	0.0	22.9	0	0.1
22	0.0	23.0	0	0.1
23	0.0	22.9	0	0.1
24	0.0	22.9	0	0.0
25	0.0	22.9	0	0.0
26	0.0	22.8	0	0.0
27	0.0	22.9	0	0.1
28	0.0	22.9	0	0.0
29	0.0	22.9	0	0.1
30	0.0	22.9	0	0.0
31	0.0	22.9	0	0.1
32	0.0	22.9	0	0.0
33	0.0	22.9	0	0.0
34	0.0	22.9	0	0.0
35	0.0	22.9	0	0.0
36	0.0	22.9	0	0.0
37	0.0	22.9	0	0.0
38	0.0	22.9	0	0.0
39	0.0	22.9	0	0.0
40	0.0	22.9	0	0.0
41	0.0	22.9	0	0.0
42	0.0	22.9	0	0.0
43	0.0	22.9	0	0.0
44	0.0	22.9	0	0.0
45	0.0	22.9	0	0.0
46	0.0	22.9	0	0.0
47	0.0	22.9	0	0.0
48	0.0	22.9	0	0.0

**TABLE 2.5 - Landfill Site Ambient Air Readings
Old Amherst Landfill CSA**

Data Collected September 20, 2005				
Station ID #	% Lower Explosion Limit (LEL) % LEL for Methane	% Oxygen % O ₂	Hydrogen Sulfide H ₂ S (ppm)	Total VOCs - PID (ppm)
49	0.0	22.9	0	0.0
50	0.0	22.9	0	0.0
51	0.0	22.9	0	0.0
52	0.0	22.9	0	0.0
53	0.0	22.9	0	0.0
54	0.0	22.9	0	0.0
55	0.0	22.9	0	0.0
56	0.0	22.9	0	0.0
57	0.0	22.9	0	0.0
58	0.0	22.9	0	0.0
59	0.0	22.9	0	0.0
60	0.0	22.9	0	0.0
61	0.0	22.9	0	0.0
62	0.0	22.9	0	0.0
63	0.0	22.9	0	0.0
64	0.0	22.9	0	0.0
65	0.0	22.9	0	0.0
66	0.0	22.9	0	0.0
67	0.0	22.9	0	0.0
68	0.0	22.9	0	0.0
69	0.0	22.9	0	0.0
70	0.0	22.9	0	0.0
71	0.0	22.9	0	0.0
72	0.0	22.9	0	0.0
73	0.0	22.9	0	0.0
74	0.0	22.9	0	0.0
75	0.0	22.9	0	0.0
76	0.0	22.8	0	0.0
77	0.0	22.9	0	0.0
78	0.0	22.9	0	0.0
79	0.0	22.9	0	0.0
80	0.0	23.0	0	0.0
81	0.0	22.9	0	0.0
82	0.0	22.9	0	0.0
83	0.0	22.9	0	0.0
84	0.0	22.9	0	0.0
85	0.0	22.9	0	0.0
86	0.0	22.9	0	0.0
87	0.0	22.9	0	0.0
88	0.0	22.9	0	0.0
89	0.0	22.9	0	0.0
90	0.0	22.9	0	0.0
91	0.0	22.9	0	0.0
92	0.0	22.9	0	0.0
93	0.0	22.9	0	0.0
94	0.0	22.9	0	0.0
95	0.0	22.9	0	0.0
96	0.0	22.9	0	0.0

**TABLE 2.5 - Landfill Site Ambient Air Readings
Old Amherst Landfill CSA**

Data Collected September 20, 2005				
Station ID #	% Lower Explosion Limit (LEL) % LEL for Methane	% Oxygen % O ₂	Hydrogen Sulfide H ₂ S (ppm)	Total VOCs - PID (ppm)
97	0.0	22.9	0	0.0
98	0.0	22.9	0	0.0
99	0.0	22.9	0	0.0
100	0.0	22.9	0	0.0
101	0.0	22.9	0	0.0
102	0.0	22.9	0	0.0
103	0.0	22.9	0	0.0
104	0.0	22.9	0	0.0
105	0.0	22.9	0	0.0
106	0.0	22.9	0	0.0
107	0.0	22.9	0	0.0
108	0.0	22.9	0	0.0
109	0.0	22.9	0	0.0
110	0.0	22.9	0	0.0
111	0.0	22.9	0	0.0
112	0.0	22.9	0	0.0
113	0.0	22.9	0	0.0
114	0.0	22.9	0	0.0
115	0.0	22.9	0	0.0
116	0.0	22.9	0	0.0
117	0.0	22.9	0	0.0
118	0.0	23.0	0	0.0
119	0.0	23.0	0	0.0
120	0.0	23.0	0	0.0
121	0.0	23.0	0	0.0
122	0.0	23.0	0	0.0
123	0.0	23.0	0	0.0
124	0.0	22.9	0	0.0
125	0.0	22.9	0	0.0
126	0.0	22.9	0	0.0
127	0.0	22.9	0	0.0
128	0.0	23.0	0	0.0
129	0.0	23.0	0	0.0
130	0.0	23.0	0	0.0
131	0.0	23.0	0	0.0
132	0.0	23.0	0	0.0
133	0.0	22.9	0	0.0
134	0.0	22.9	0	0.0
135	0.0	22.9	0	0.0
136	0.0	23.0	0	0.0
137	0.0	23.0	0	0.0
138	0.0	23.0	0	0.0
139	0.0	23.0	0	0.0
140	0.0	23.0	0	0.0
141	0.0	23.0	0	0.0
142	0.0	23.0	0	0.0
143	0.0	22.9	0	0.0
144	0.0	22.9	0	0.0

**TABLE 2.5 - Landfill Site Ambient Air Readings
Old Amherst Landfill CSA**

Data Collected September 20, 2005				
Station ID #	% Lower Explosion Limit (LEL) % LEL for Methane	% Oxygen % O ₂	Hydrogen Sulfide H ₂ S (ppm)	Total VOCs - PID (ppm)
145	0.0	23.0	0	0.0
146	0.0	22.9	0	0.0
147	0.0	22.9	0	0.0
148	0.0	22.9	0	0.0
149	0.0	23.0	0	0.0
150	0.0	23.0	0	0.0
151	0.0	23.0	0	0.0
152	0.0	22.9	0	0.0
153	0.0	22.9	0	0.0
154	0.0	22.9	0	0.0
155	0.0	22.9	0	0.0
156	0.0	22.9	0	0.0
157	0.0	22.9	0	0.0
158	0.0	22.9	0	0.0
159	0.0	22.9	0	0.0
160	0.0	22.9	0	0.0
161	0.0	22.9	0	0.0
162	0.0	22.9	0	0.0
163	0.0	22.9	0	0.0
164	0.0	22.9	0	0.0
165	0.0	22.9	0	0.0
166	0.0	22.9	0	0.0
167	0.0	22.9	0	0.0
168	0.0	23.0	0	0.0
169	0.0	22.9	0	0.0
170	0.0	22.9	0	0.0
171	0.0	22.9	0	0.0
172	0.0	22.9	0	0.0
173	0.0	22.9	0	0.0
174	0.0	22.9	0	0.0
175	0.0	22.9	0	0.0
176	0.0	22.9	0	0.0
177	0.0	22.9	0	0.0
178	0.0	22.9	0	0.0
179	0.0	22.9	0	0.0
180	0.0	22.9	0	0.0
181	0.0	22.9	0	0.0
182	0.0	22.9	0	0.0
183	0.0	22.9	0	0.0
184	0.0	22.9	0	0.0
185	0.0	22.9	0	0.0
186	0.0	22.9	0	0.0
187	0.0	22.9	0	0.0
188	0.0	22.9	0	0.0
189	0.0	22.9	0	0.0
190	0.0	22.9	0	0.0
191	0.0	22.9	0	0.0
192	0.0	22.9	0	0.0

**TABLE 2.5 - Landfill Site Ambient Air Readings
Old Amherst Landfill CSA**

Data Collected September 20, 2005				
Station ID #	% Lower Explosion Limit (LEL) % LEL for Methane	% Oxygen % O ₂	Hydrogen Sulfide H ₂ S (ppm)	Total VOCs - PID (ppm)
193	0.0	22.9	0	0.0
194	0.0	22.9	0	0.0
195	0.0	22.9	0	0.0
196	0.0	22.9	0	0.0
197	0.0	22.9	0	0.0
198	0.0	22.9	0	0.0
199	0.0	22.9	0	0.0
200	0.0	22.9	0	0.0
201	0.0	22.9	0	0.0
202	0.0	22.9	0	0.0
203	0.0	22.9	0	0.0
204	0.0	22.9	0	0.0
205	0.0	22.9	0	0.0
206	0.0	22.9	0	0.0
207	0.0	22.9	0	0.0
208	0.0	22.9	0	0.0
209	0.0	22.9	0	0.0
ppm = parts per million PID = Photoionization Detector VOCs = Volatile Organic Compounds				

TABLE 2.6 - Soil Gas Monitoring Summary
Old Amherst Landfill CSA Study

Location or Station ID	%CH ₄ 10/11/05	%LEL 10/11/05	%CO ₂ 10/11/05	%O ₂ 10/11/05	H ₂ S (ppm) 10/11/05	CO (ppm) 10/11/05	VOCs - PID (ppm) 10/11/05
Ambient @ Start	0.0	0	0.0	20.9	0	0	0.0
Perimeter Gas Monitoring Wells							
PGW-1	0.0	0	0.0	20.9	0	0	0.0
PGW-2	0.0	0	0.1	20.9	0	0	0.0
PGW-3	0.0	0	0.0	20.9	0	0	0.0
PGW-4	0.0	0	0.9	19.8	0	0	0.0
PGW-5	0.0	0	9.3	6.3	0	0	0.0
PGW-6	0.0	0	0.0	20.9	0	0	0.0
PGW-7	0.0	0	4.7	15.9	0	0	0.0
Existing Soil Gas Monitoring Points							
SG-4 0+00	0.0	0	0.1	20.6	0	0	0.0
SG-4 0+50	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-4 0+75	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-7 0+00	0.0	0	2.6	17.9	0	0	0.0
SG-7 0+50	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-7 0+75	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-13 0+00	0.0	0	5.6	14.0	0	0	0.0
SG-13 0+50	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-13 0+75	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-14 0+00	0.0	0	3.8	16.4	0	0	0.0
SG-14 0+50	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-14 0+75	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-16 0+00	0.0	0	4.4	16.1	0	0	0.0
SG-16 0+50	0.0	0	1.3	19.3	0	0	0.0
SG-16 0+75	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-17 0+00	0.0	0	12.3	5.0	0	0	0.0
SG-17 0+50	0.0	0	0.4	20.3	0	0	0.0
SG-17 0+75	xxx	xxx	xxx	xxx	xxx	xxx	xxx
SG-19 0+00	0.0	0	0.2	20.6	0	0	0.0
SG-19 0+50	No Flow	No Flow	No Flow	No Flow	No Flow	No Flow	No Flow
SG-19 0+75	0.0	0	1.8	19.2	0	0	0.0
SG-20 0+00	0.0	0	4.7	12.8	0	0	0.0
SG-20 0+50	0.0	0	1.2	19.6	0	0	0.0
SG-20 0+75	0.0	0	1.0	19.9	0	0	0.0
SG-21 0+00	48.1	>100	27.4	0.2	0	0	0.0
SG-21 0+50	0.0	0	2.9	17.8	0	0	0.0
SG-21 0+75	0.0	0	1.7	19.5	0	0	0.0
SG-22 0+00	28.4	>100	23.9	0.0	0	0	0.0
SG-22 0+50	0.0	0	0.0	20.9	0	0	0.0
SG-22 0+75	0.0	0	1.5	19.5	0	0	0.0
Existing Landfill Gas Vents							
GV-1	0.0	0	0.0	20.8	0	0	0.0
GV-2	0.0	0	0.0	20.8	0	0	0.0
GV-3	0.0	0	0.0	20.8	0	0	0.0
GV-4	0.0	0	0.0	20.9	0	0	0.0
Ambient @ Completion	0.0	0	0.0	20.9	0	0	0.0
Atmospheric Pressure ("Hg)	29.7 - 29.8						

LEL - Lower Explosion Limit; Equivalent to 5% by total volume for Methane (CH₄)

PID - Photoionization Detector

**Table 2.7 - Groundwater Elevation Summary
Old Amherst Landfill CSA Study**

Monitoring Well #	Well Depth (feet)	Screen Depth (feet bg)	Screened Aquifer Unit	Elevation USGS msl			Groundwater Elevations (USGS feet msl)		
				Ground (feet msl)	Top Casing (feet msl)	Top PVC (feet msl)	11-Oct-05	10-Nov-05	
PGW-1	45	5-45	Surficial	263.8	267.09	266.98	40.18 226.80	38.47 228.51	
PGW-2	45	5-45	Surficial	268.0	271.13	271.00	43.11 227.89	37.75 233.25	
PGW-3	35	6-35	Surficial	271.5	274.80	274.66	38.80 237.86	28.01 246.65	
PGW-4	20	5-20	Surficial	252.6	255.68	255.46	13.48 241.98	8.59 246.87	
PGW-5	50	5-50	Surficial	242.3	245.43	245.33	46.64 198.69	43.44 201.89	
PGW-6	88	8-88	Surficial	276.9	279.83	279.57	80.19 199.38	80.72 198.85	
PGW-7	50	5-50	Surficial	282.6	285.90	285.64	<52.60 <233.04	<52.60 <233.04	
#3-68	49	36-49	Surficial	172.7	173.08	xxx	xxx	4.48 168.60	
#5-68	44	44-54	Surficial	170.8	171.20	xxx	xxx	xxx	
#6-68	50	42-50	Surficial	170.8	171.70	xxx	xxx	xxx	
#11-71	62	57-62	Surficial	251.8	252.49	xxx	xxx	29.98 222.51	
#3-80	123	118-123	Confined	173.1	174.66	xxx	xxx	5.55 169.11	
#1-83	110	106-110	Confined - Artesian	168.9	161.73	xxx	xxx	0.00 161.73	
#2-83	98	94-98	Confined - Artesian	162.1	162.44	xxx	xxx	0.00 162.44	
#3-83	107	102-107	Confined - Artesian	162.1	164.81	xxx	xxx	0.00 164.81	
#2-85	40	30-40	Surficial	184.8	185.56	xxx	xxx	13.90 171.66	
#3-85	46	36-46	Surficial	172.0	173.08	xxx	xxx	0.60 172.48	
#5-89	72 +/-	62-72 +/-	Surficial	261.0	261.35	261.23	261.23	63.95 197.28	
#6-89	160 +/-	150-160 +/-	Confining Layer	242.1	244.34	243.10	243.10	43.49 199.61	
#1-94				163.5	165.18	xxx	xxx	xxx	
#1-03	15	6-15	Surficial	192.5	195.29	194.91	194.91	5.88 189.03	
#2-03	18	8-18	Surficial	266.2	268.50	268.20	268.20	9.48 258.72	
Note: 9.48 = Measured Depth to Groundwater from Top PVC or Casing 258.72 = Groundwater Elevation (USGS feet msl)									